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(54) Title: Method for the manufacture of multilayer printed circuit boards

(57) Abstract

Objective: To offer a method for the manufacture of multilayer printed circuit boards of improved adhesion between the inner layer material and additive polyimide resin.

Composition: For the manufacture of multilayer printed circuit boards, in which the outer layer material is provided to and integrated with the top or bottom face of the inner layer material in a set number of sheets via an additive polyimide resin layer, a method for the manufacture of multilayer printed circuit boards in which, after etching, the inner layer material's circuit surface is oxidized, reduced and then treated with a coupling agent.

Patent Claims

Claim 1:

For the manufacture of multilayer printed circuit boards, in which the outer layer material is provided to and integrated with the top or bottom face of the inner layer material in a set number of sheets via an additive polyimide resin layer, a method for the manufacture of multilayer printed circuit boards in which, after etching, the inner layer material's circuit surface is oxidized, reduced and then treated with a coupling agent.

Detailed explanation of the invention

[0001]

This invention relates to a method for the manufacture of multilayer printed circuit boards used in electronic devices, etc.

[0002]

Conventional technology

Conventional multilayer printed circuit boards are produced by lamination molding of an inner layer material and an outer layer material with a resin layer placed among the inner layer material and/or between the inner and outer layer materials, however, the adhesive strength of the additive polyimide resin between the inner and outer layers is weak.

[0003]

Problem this invention intends to solve

This invention addresses the said problem and it offers a manufacturing method for multilayer printed circuit boards with improved adhesion between the inner layer material and the additive polyimide resin.

[0004]

Means to solve the problem

This invention is a method for the manufacture of multilayer printed circuit boards in which an outer layer material is provided to and integrated with the top or bottom face of the inner layer material in a set number of sheets via an additive polyimide resin and in which, after etching, the inner layer material's circuit surface is oxidized, reduced and treated with a coupling agent. This invention is detailed below.

[0005]

The inner layer material of this invention is a metal-clad laminated plate one side or both sides of which is/are etched to form the circuit. The etched circuit surface is oxidized by the black oxide [sic] steel treatment, etc., and then the oxide layer on the circuit surface is reduced with the reducing agent, aminoborane, etc., and thereafter it is coupler-treated with a silane coupler, etc.

[0006]

In the said coupler treatment, the inner layer material is dipped into the coupler solution and heated to the required temperature which is selected for the type of coupler used.

[0007]

A number of sheets of inner layer material is used in this invention according to the number of layers of circuits, and the additive polyimide resin applied on the surface of the inner layer material can be a modified additive polyimide. This resin layer is formed by the coating of liquid resin or in the form of a film or sheet or in the form of a resin-impregnated substrate or in a combination of these forms also. The resin-impregnated substrate can be woven or unwoven cloth or mat or a combination of these, made of organic fibers, such as polyester, polyamide, polyvinyl alcohol, acrylic, etc., or natural fibers such as cotton, etc., or inorganic fibers of glass, asbestos, etc.

[0008]

The outer layer material of this invention can be a one-sided metal-clad laminated plate, two-sided metal-clad laminated plate, only one side of which has the circuit formed in it, etc. The metal of the laminated plate can be copper, aluminum, bronze, nickel, iron, etc., and a foil of such a metal can be placed on the laminated plate to produce the outer layer material of this invention.

[0009]

Practical Example

This invention is explained below with practical examples. Incidentally, this invention is not limited to these practical examples.

[0010]

Practical Example 1

After the circuit is formed by etching both sides of a 1 mm thick two-sided copper-clad laminated plate, it is treated with black oxide then reduced with aminoborane and dipped for 60 seconds in an aqueous solution of 0.5 weight % acetic acid to make 1 weight % of epoxysilane coupling (Shin-Etsu Silicon Company KBM-403). Thereafter it is heated at 110°C for 30 minutes to produce an inner layer material. Then, two sheets of glass cloth, impregnated with 0.1 mm thick additive polyimide resin and dried, are placed on the top and bottom faces of the said inner layer material and a 0.035 mm thick copper foil is placed on its outermost face. The produced laminate is molded at 40 kgf/cm^2 pressure and 180°C temperature for 120 minutes to obtain a 4-layered printed circuit board. Adhesion of the inner layer was measured to check the adhesive strength between the inner layer material and the additive polyimide resin. The result is shown in Table 1.

[0011]

Practical Example 2

A circuit is etched on both sides of a 1 mm thick two-sided copper-clad laminated plate, similarly to Practical Example 1. Then it is treated with black oxide and reduced with aminoborane. Next, it is dipped into a 1 weight % solution of an aminosilane coupler (Shin-Etsu Silicon Company, BM-603) in 0.5 weight % aqueous acetic acid solution for 60 seconds and heated at 110°C for 30 minutes to produce the inner layer material. The processes other than the use of an inner layer material were the same as in Practical Example 1 to produce the 4-layered printed circuit board of this practical example. The adhesion between the said inner layer material and the additive polyimide resin was measured. The results are shown in Table 1.

[0012]

Comparison Example

A circuit is formed on both sides of a two-sided copper-clad laminated plate of 1 mm thickness, similarly to Practical Example 1, and it was treated with black oxide and reduced with aminoborane. Except for using said plate as the inner layer material without coupler treatment, a 4-layered printed circuit board was produced similarly to Practical Example 1. The adhesion of the inner layer was measured to check the adhesion between the said circuit board and the additive polyimide resin. The results are shown in Table 1.

[0013]

Table 1

	Practical Example 1	Practical Example 2	Comparison Example
adhesion of the inner layer (kgf/cm)	1.10	1.05	0.30

[0014]

The above results confirm the improvement of adhesion between the inner layer material and the polyimide resin by the method of this invention over that of a conventional multilayer printed circuit board.

[0015]

Effect of the Invention

As is clear from Table 1, a multilayer printed circuit board of improved inner layer adhesion, that is, the adhesion between the inner layer material and the additive polyimide resin, can be produced by the method of this invention, therefore, this invention is useful for the manufacture of a multilayer circuit board of superior performance.